

CLIMATIC FORECASTING OF NET INFILTRATION AT YUCCA MOUNTAIN USING ANALOGUE METEOROLOGICAL DATA

Boris Faybishenko

510/486-4852, bafaybishenko@lbl.gov

RESEARCH OBJECTIVES

The objective is to develop a semi-empirical model and forecast average net infiltration rates, using the limited meteorological data from analogue meteorological stations, for interglacial (present-day), and future monsoon, glacial transition, and glacial climates over the Yucca Mountain region.

APPROACH AND METHODS

Net infiltration, aridity, and precipitation-effectiveness (P-E) indices were calculated using a modified Budyko's water-balance model, with reference surface potential evapotranspiration determined from the radiation-based Penman formula. The computed net infiltration rates were corroborated by comparing them with the empirically and numerically determined groundwater recharge and percolation rates through the unsaturated zone from published data.

ACCOMPLISHMENTS

Net infiltration rates are forecasted to generally increase from the present-day climate to monsoon climate, to glacial transition (intermediate) climate, and then to the glacial climate, following a power law relationship between net infiltration and precipitation. The forecasting results indicate the overlap between the ranges of net infiltration for different climates (Figure 1). The calculated net infiltration rates have yielded a good match with other field and modeling study results pertaining to groundwater recharge and percolation flux through the unsaturated zone at Yucca Mountain. This comparison indicates the robustness of the simple water-balance approach used in this study.

SIGNIFICANCE OF FINDINGS

Computed present-day and potential future net infiltration can be used as a hydrologic parameter to assess the rate of deep percolation, groundwater recharge, radionuclide transport, and seepage into tunnels—all of which are, in turn, useful

parameters for the performance assessment of the proposed nuclear waste repository at Yucca Mountain, Nevada.

RELATED PUBLICATION

Faybishenko, B., Climatic forecasting of net infiltration at Yucca Mountain using analogue meteorological data. *Vadose Zone Journal*, 6, 77–92, 2007.

ACKNOWLEDGMENTS

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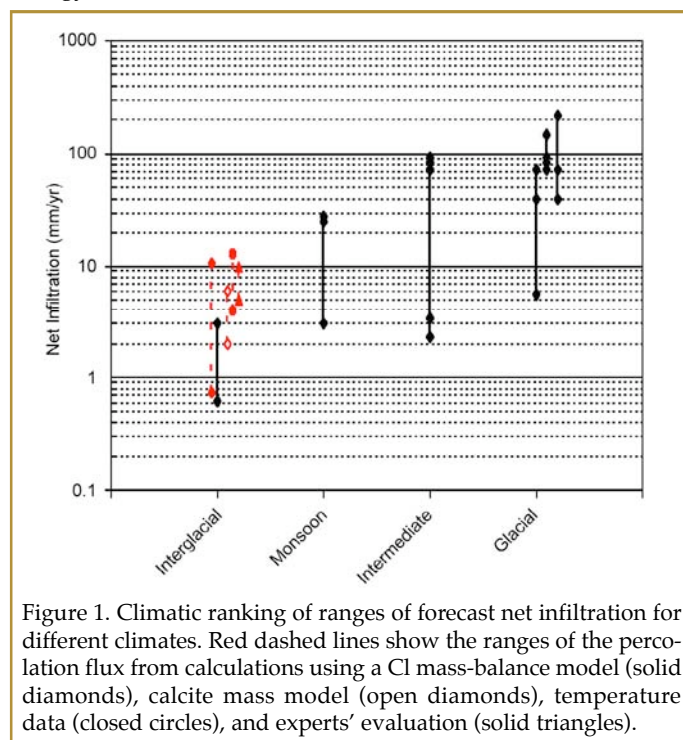


Figure 1. Climatic ranking of ranges of forecast net infiltration for different climates. Red dashed lines show the ranges of the percolation flux from calculations using a CI mass-balance model (solid diamonds), calcite mass model (open diamonds), temperature data (closed circles), and experts' evaluation (solid triangles).